Final report

PDS: Growing More Pasture During Winter

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Abstract

Red-meat producers across south-eastern Australia annually navigate what is commonly known as the 'winter feed gap'. This gap generally dictates the number of livestock a property can sustainably run year-round.

Three operations were selected across Tasmania to demonstrate cost-effective management practices to alleviate this problem. Each operation represented a varying climate, established pasture base, stocking rate intensity. A treatment and control were to be implemented for each site. These focussed on use of a nitrogen fertiliser and a growth promotant, gibberellic acid.

Pasture levels, quality and stocking rate were monitored to determine the associated production benefits. Given the prohibitive costs of fertiliser in year 1 and site challenges, the project concluded early given the challenging outlook for the remaining two years.

The key project findings were

1. A 16% increase in pasture growth rates was captured with increasing growth promotant application (gibberellic acid) from one to two applications
2. Utilising fertiliser and growth promotants were 22% more cost effective than the cheapest purchased feed

This project benefited to the industry by practical demonstration of proven pasture management strategies. It showed even with high fertiliser input prices, this is the most cost-effective way to meet winter feed requirements.

Executive summary

Background

The purpose of this Co-contributor Producer Demonstration Site (PDS) project is to demonstrate maximum pasture production achievable through winter using pasture management practices such as fertiliser, soil ameliorants, grazing management, and growth promotants to increase the carrying capacity and subsequently the profitability of the grazing system.

The core producer group/audience was Tasmania mixed farming and livestock producers, predominately beef, prime lamb, and wool operations. Tasmania was an ideal climate to test given the prolonged, coolest winter conditions existing across the south-east of Australia.

The project methodology and results provided producers with a practical understanding of how to utilise a combination of pasture management tools, including fertiliser and growth promotants, to reduce the winter gap. It will also demonstrate how to determine the best economic course of action given varying seasonal conditions, fertiliser, and feed prices.

Objectives

The project established three demonstration sites; however, the project only ran for one year given the difficulties associated with site establishment and variables, seasonal conditions, and the prohibitive cost of fertiliser inputs.

Though the key objectives of increasing carrying capacity by 25%, increased animal production by 25% & enterprise profit by 20% were not met, increased carrying capacity and pasture growth were demonstrated.

Methodology

Three sites with various established pasture mixes were selected. Each site identified a control and treatment area with site specific protocols established.

Soil testing occurred in April 2022 to a depth of 10cm. The planned tissue testing on clover plants could not be carried out this time given the seasonal conditions and lack of active growth. Given delays in soil test results only Peddie treatment and controls were implemented given resent soil tests and the significant feed gap anticipated with a change of lambing date.

Treatment and control for the Peddie site included 80 kg/ha of urea on the 13th May 2022 and one application of gibberellic acid on the 12th June 2022. The treatment site received an additional application of gibberellic acid on the 28th July 2022.

Pasture coverage and legume content were captured and monitored pre and post winter predominately utilising the MLA pasture ruler. Quadrant cuts and dry matter testing also occurred on farm. Stocking rates inclusive of weaning rates were also captured.

In addition to this production data, a cost benefit analysis was completed for the Peddie site comparing the cost of fertiliser and growth promotants versus conserved home-grown feed and purchased-in feed.

Results/key findings

The key project findings are summarised as:

1. A 16% increase in pasture growth rates was captured with increasing growth promotants application (gibberellic acid) from one to two applications
2. Utilising fertiliser and growth promotants were 22% more cost effective than the cheapest purchased feed

36 core producers, 21 observer producers and 2 non-producer observers were engaged through PDS activities. Through pre-project assessment of producer knowledge, attitude, skills, and aspirations, it was identified that:

3. Assessing pasture quality and using fertiliser, ameliorates are areas where producers have less confidence, compared to assessing pasture quantity
4. The average mid-winter stocking rate was 10.6 dse/ha versus an annual average stocking rate of 13.7 dse/ha. This difference of 3.1 dse/ha demonstrates winter is still a constraint to optimising stocking rates throughout the year.

Benefits to industry

This project has demonstrated proven pasture management strategies, is still the most cost-effective way to boost winter feed production, even with high fertiliser input prices. These management strategies and the PDS methodology can be replicated on-farm. This involves quantifying operation variables inclusive of:

- Pasture quantity and quality for feed budgeting
- Livestock class, pregnancy status and numbers to identify feed deficits or surpluses
- The cost of fertiliser inputs and alternatives such as conserved or purchased in feeds

Future research and recommendations

In lower fertiliser pricing conditions, it would be worthwhile further demonstrating the effectiveness of these pasture management techniques, for both improved and native pasture management across a variety of environmental conditions.

PDS key data summary table

Project Aim:
To demonstrate increased pasture production as a result of implementing pasture management tools including the use of fertiliser, plant growth promotants, grazing management and soil ameliorants where required.

	Comments		Unit
Production efficiency benefit (impact)			
Pasture growth rate – 80 kg/ha Urea & gibberellic acid (1 application) vs. 80 kg Urea/ha & gibberellic acid (2 applications)		5.1 16	kg DM/ha %
Scenario 1: Urea & GA vs home grown hay (7 kg/DM to 1 unit N response – autumn application)	*High cost of urea comparative to cheap home-grown hay*	-$0.027	$/kg DM fed
Scenario 2: Urea & GA vs purchased hay, cheapest supplementary feed available (7 kg/DM to 1 unit N response – autumn application) – own hay reserves exhausted	*Given higher cost of purchased hay, urea & GA becomes breakeven*	$0.035	$/kg DM fed
Number of core participants engaged in project		36	number
Number of observer participants engaged in project		23	number
Core group no. ha		110,220	ha
Observer group no. ha		40,063	ha
Core group no. sheep		551,967	hd sheep
Observer group no. sheep		244,580	hd sheep
Core group no. cattle		21,056	hd cattle
Observer group no. cattle		28,208	hd cattle

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1. Background

1.1 The Problem

Red-meat producers across south-eastern Australia are faced with low pasture growth through winter, commonly known as the 'winter feed gap'. This gap dictates grazing systems as it affects the number of livestock a property can sustainably run year-round. The length of the feed gap and the extent of the deficit during this period varies across regions as pasture growth rate is linked to temperature and day length. While climatic factors are out of producer's control, management decisions and practices determine how effectively an operation navigates this production challenge.

1.2 The main question and why

What is the most economical way to increase pasture growth through the winter period? We must also consider how boosting pasture growth using fertiliser, ameliorating soil constraints and use of pasture growth promotants compare with the alternative of supplementary feeding.

Answering this question will allow south-eastern pastoral farmers determine the most profitable option for their farm scenario to optimise winter stocking rates. By optimising winter stocking rates, we can also maximise the year-round carrying capacity for a pastoral operation.

1.3 The target audience

The project is relevant to any pastoral operation in south-eastern Australia utilising perennial temperate C4 grasses and legumes. With sites being based in Tasmania, face-to-face activities targeted local red meat and wool producers.

The core producer group was comprised of Tasmanian-based Aggregate Consulting benchmarking groups. These groups encompassed a total of 28 pasture and mixed-farming operations which form two benchmarking groups.

The wider observer group audience can be split into other Tasmanian based producers (includes Aggregate's Flinders Island benchmarking group) and mainland producers. Mainland producers include an additional 12 Aggregate benchmarking groups. The combined number of benchmarking operations in the observer group was 171. A further eight producers and service providers were engaged through the webinar event.

1.4 Project results and use

The project encountered several obstacles during the first year. Given these challenges and likely outlook with input costs, the project concluded after the first year. This was due to:

- Significant increase in fertiliser inputs at commencement of project which resulted in
    - A lower-than-expected cost-benefit for use of nitrogen inputs
    - Decreased engagement with producers given the above
    - Challenges around site set-up given seasonal conditions and naturalised species

The project methodology and results provided producers with a practical understanding of how to utilise a combination of pasture management tools, including fertiliser and growth promotants, to reduce the

winter gap. It will also demonstrate how to determine the best economic course of action given varying seasonal conditions, fertiliser, and feed prices.

2. Objectives

The original project objectives are listed as:

1. *Conduct three demonstration sites (inclusive of a native/low quality and an improved/high quality site), running for three years. The sites will be grazed by sheep/cattle, demonstrating increased pasture production as a result of implementing pasture management tools including the use of fertiliser, plant growth promotants, grazing management and soil ameliorants where required. As a result of the increased pasture production, sites will demonstrate:*
    a. *Increased carrying capacity by 25% (measured as dry sheep equivalents per hectare).*
    b. *Increased animal production per hectare by 25%, measured in either kilograms of lamb, beef or wool depending on enterprise used.*
    c. *Increased profit per hectare by 20%, taking into account the additional operating costs in obtaining the additional production.*

Three demonstration sites where established, however the project only ran for one year. These sites where identified as Ellis, Green and Peddie. On initial establishment, all sites experienced below average rainfall conditions. Pasture was non-active (predominately dead/dried off), making species identification and tissue testing impossible.

Figure 1. Ellis property 13th April 2022. The absence of an autumn break at Bothwell meant no active pasture growth for tissue testing.

The native pasture site (Green) was selected given the hilly topographic and high rock content. It was expected to be native grasses (predominately kangaroo). On further inspection in spring, it was found to be predominately volunteer/self-sown clovers with some cocksfoot/rye grass and limited native species. Hence this site was deemed not to meet the native/low quality requirement.

Image 2. Green property 14th April 2022. There was minimal FOO which made species identification impossible.

Image 3. Green property 28th August 2022. Rights shows an improved cocksfoot pasture (not in PDS) and left the control paddock. Despite no improvement in the control paddock, this pasture was dominant by introduced cocksfoot, rye grass and clover species with < 15% native grasses.

Given delays in soil testing results, treatments for fertiliser and plant growth promotants only went in Autumn application window for one site as planned. This was for the Peddie site, predominately a perennial ryegrass base with some clover. This was possible because soil baselines and management plans had previously been established prior to the project commencement.

Given the prohibitive cost of urea and other N-fertilisers a conservative approach to N with further emphasis placed on the use of growth-promotants. As such, objectives 1 a, b and c where not demonstrated in the first year. The Ellis sites was also significantly impacted by worm/beetle infestations at the end of year 1. Losses were confined to approximately 15% of the area for perennial ryegrass which would have been problematic moving into year 2 assessments.

Though additional pasture DM was recorded at end of winter at a similar stocking rate we should also considering the level of accuracy of pasture readings

2. *Conduct an analysis of the cost-benefit of using these tools to boost pasture production through winter and the increased income from increasing the carrying capacity of the paddocks.*

This was completed for the Peddie site only.

3. *Create three written case studies incorporating a cost-benefit analysis on the three sites from the first 3 years of the project to be available publicly.*

This outcome was not met given the reduction in project period and limited findings.

4. *Present updates and outcomes of the PDS sites and the associated cost-benefit analysis to each of Aggregate's benchmarking groups as part of normal benchmarking meetings.*
5. *Conduct an online open-attendance webinar to present the outcomes of the project.*
6. *Conduct an annual open-attendance field day (3 total in 3 years) during winter to encourage interaction with producers outside of Aggregate's client base.*
7. *Conduct 2x a 1-day workshops, one for core group & one open to any producer. Workshops will be focused on skill development.*

These outcomes were not met at the time of this report publication given the reduction in project period and limited findings. The initial field day was moved due site issues and the rescheduled day resulted in insufficient RVSP's due to flooding in surrounding regions. However, the initial findings were distributed via Tasmanian Benchmarking group meetings and to the public released as part of the webinar event on the 16th November 2022.

8. *Assessing the quality and quantity of pasture to calculate Metabolisable energy*
9. *Implementing data collected into a feed budget to determine if there will be a feed shortage in coming months and the timing of the shortage.*
10. *Discussion around pasture management tools that can be implemented to address issues identified in the feed budget to accompany the demonstration site outcomes.*

These objectives were met via the initial and post winter site assessments and the associated management plans developed.

11. *Discussion around any implications to animal health as a result of pasture management strategies implemented.*
12. *75% of core producers and 50% of observer producers will have adopted the use of pasture management tools to boost their pasture production.*
13. *80% of core producers and 50% of observer producers will have increased their understanding of the benefit of using pasture management tools during the winter period and have confidence in using this approach in future.*

These objectives were not captured/met given the project concluded early.

3. Demonstration Site Design

3.1 Methodology

Three Tasmanian sites were selected, with the Green site considered to be lower quality, native pastures (Green Site), and the Peddie site considered to be high quality pastures. Site sizes were variable but averaged approximately 40 hectares in size (total across the control and treatment paddocks).

Each site had an accompanied 'control' site considered to have a similar pasture & soil fertility base which will only have maintenance fertiliser applied.

With 3 sites established, pasture coverage and legume content were captured and monitored for any changes in legume pasture content/mix. We intended to liaise with Rowan Smith (TIAR/UTAS) to determine if this can be aligned with the legume establishment project. However, all sites were established/existing pasture sites.

Soil testing occurred on the 13th & 14th April 2022 to a depth of 10cm. The depth was based on the limited time frame of the project and expected influence down the profile. The planned tissue testing on clover plants could not be carried out this time given the seasonal conditions and lack of active growth.

Given delays in soil test results only Peddie treatment and controls were implemented given resent soil tests and the significant feed gap anticipated with a change of lambing date.

Further soil samples and tissue tests were taken towards end of 2022. However, as the decision was made to conclude the project there was no value in testing these samples.

Treatment sites were to be managed to increase production throughout the winter period, including the use of fertiliser, plant growth promotants, grazing management and soil ameliorants. Soil ameliorants were to be applied, pending soil tests, to achieve a target pH > 5.

Pasture biomass in both the control and treatment paddocks were assessed to inform pasture budgeting calculations. The *preferred* method of measurement was the MLA pasture ruler. However, quadrant cuts were also taken in August to determine pasture dry matter content (Image 4), weighed and dried utilising an air-fryer on-farm (Image 5). This was then used to calibrate against readings with MLA pasture ruler.

Image 4. A quadrant cut at the Ellis site in August 2022. Cuts were taken down to the crown of the plant to represent the point at which plant re-growth and resilience will be affected (more than desired grazing point). This ranged from 350 – 600 kg DM/ha depending on ground cover.

Image 5. Ellis quadrant cut being weighed into the air-fryer tray.

Sites were stocked over the winter period with the number of stock, class of stock and days grazing captured. Total DSEs were then calculated to determine actual stocking rates.

For the core producer group the project was to evaluate

1. Pre and post knowledge, skills, and confidence
2. Number producers directly and indirectly engaged (+ demographics)
3. Practice change – intended and actual

The numbers of producers engaged was captured however the practice change evaluation was not possible given no post-project assessment with the early project conclusion.

3.2 Economic analysis

The project was to determine for each site:

1. Production efficiency (Kg red meat / ha)
2. Production efficiency (kg red meat / dse)
3. Pasture productivity (kg DM / ha)
4. Stocking rate (DSE/ha)
6. Cost of Production ($/ kg red meat)
7. Gross Margin / ha
8. Gross Margin / dse

Given the early conclusion only stocking rate and pasture productivity specific for the sites were captured and analysed. All other parameters are captured for each site via their annual benchmarking data. A cost benefit scenario comparing the fertiliser treatment regime home-grown and purchased feeds was carried out for the Peddie operation only.

3.3 Extension and communication

Engagement / Adoption Activities	**Details**
Field days (min. annually)	Annual field days conducted in winter, open to any interested producers.
Webinar/s	One webinar, at the end of the project. Open attendance.
Workshop/s	By Year 3, 1 workshop for the core-producer group and 1 workshop open to all producers.
Case studies	Three case studies for each site will be conducted and publicly available.
Other (please provide details): Core group visits	Throughout the project and as part of normal benchmarking group meetings, producers from these groups will visit the sites close to their location **OR** will have updates presented to them to fuel discussion on the project at meetings depending on what is most appropriate at the time.

3.4 Monitoring and evaluation

The monitoring and evaluation originally included:

- Clear identification of practices and metrics being demonstrated and measured
- Collection of data on producer numbers and animals, and area potentially impacted by the project
- Entrance surveys of producers to benchmark current knowledge and skills in relation to the subject
- Benchmark current practices in relation to the subject
- Exit surveys of producers to enable assessment of changes in:

  i. Reactions (perceptions, enthusiasm etc.) as a result of the project
  ii. Knowledge, Attitudes, Skills, and Aspirations
  iii. Practices

- Extent of and impact from communication / extension activities outside of the PDS project participants

Given the early conclusion of the project no exit surveys were collected and assessed.

4. Results

4.1 Demonstration site results

Table 1. Summary of year 1 results for the 3 sites

Operation	Ellis		Green		Peddie	
Paddock names	Home Run East	Home Run West	Tree Guard	Cattle Yard	6A East	Six B West
Designation	Control	Treatment	Control	Treatment	Control	Treatment
Entry Date	1/06/22	1/06/22	1/06/22	1/06/22	30/07/22	30/07/22
Exit Date	30/09/22	30/09/22	30/09/22	30/09/22	29/09/22	29/09/22
Days on feed	**121**	**121**	**121**	**121**	**61**	**61**
Av. Stocking Rate (hd/ha)	12.2	13.0	5.5	5.5	11.7	11.8
Total Pasture Grown (kg DM/ha)	3,177	3,465	1,353	1,353	1,919	2,234
Diff. pasture grown (kg DM/ha)		288		0		315
Av. growth rate (kg DM/ha/dy)	26.0	28.4	11.1	11.1	30.9	36.0
Diff. growth rate (kg DM/ha/dy)		2.4				5.1
Diff. growth rate (%)		9%				16%

It was noted the difference in pasture growth rates between the two Ellis sites despite the absence of a treatment and control program in year one. There was nothing in soil tests to explain this difference (see Appendix 7.1). As such this was site topography, pasture mix and accuracy of pasture measurements.

The first year of Peddie control and treatment, the treatment (additional application of gibberellic acid) yielded an additional 300 kg DM/ha at the end of winter. This 16% increase growth rate from an additional application of gibberellic acid clearly demonstrated the benefits of growth promotants. The PDS control/treatment design could a been improved to include a no-action/management control plot.

Thought it seems likely seems likely that 25% growth rate target (Objective 1 b) would have been met, we did not capture sufficient data to conclusive demonstrate this outcome

Image 6. The Peddie treatment grazing at the end of winter averaged 1,400 kg DM/ha, 300 kg DM/ha more than the control with insignificant difference in stocking rate.

The limited data available for the Green site yielded no results for comparison.

4.2 Economic analysis

4.2.1 The cost benefit analysis: Peddie Treatment vs. various supplementary feeds

For the treatment it was assumed there was a 7:1 response for pasture growth to N units applied in early-mid autumn. The treatment involved 80kg/ha urea with two applications of gibberellic acid (100ml/ha). With urea at $1,200/mt the cost per kilogram for additional pasture generated (additional growth minus a wastage factor of 25%) equated $0.35 kg DM as summarised in table 2 below.

Table 2 Cost of additional pasture achieved for Peddie site treatment

Treatment	Rate	Units N	Total cost spread	Pasture response	Additional pasture grown	Cost pasture grown	Waste factor	Cost fed	Feed ME	Cost fed
Units	kg/ha	kg/ha	$/ha	kg DM: N	kg/ha DM	$ kg/DM	%	$/kg DM	MJ/kg DM	$/MJ
Urea & GA x 2	80	37	$68	7.0	258	$0.26	25%	$0.35	12.0	$0.029

This was assessed against existing home-grown pasture hay on-hand and additional purchased feed costs to determine which option/s were most cost-effective for the operation as summarised in table 3 below.

Table 3 Cost of alternative feeds for Peddie treatment

Source	Feed type	Cost delivered farm	Dry Matter	Cost	Feed out cost	Waste Factor	Cost Fed	Cost Fed	Feed ME	Cost Fed
Units		$/mt	%	$/mt DM	$/mt	%	$ /mt DM	$ /kg DM	MJ /kg DM	$ / MJ
Homegrown	Past. Hay	$120	85%	$141	$20	35%	$248	$0.22	8.0	$0.027
Purchased	Past. Hay	$157	85%	$185	$20	35%	$315	$0.28	8.0	$0.036
Purchased	Luc. Hay	$183	85%	$215	$20	35%	$362	$0.33	9.0	$0.037
Purchased	Barley	$409	90%	$454	$10	5%	$489	$0.48	11.5	$0.042
Purchased	Straw	$110	90%	$122	$20	50%	$284	$0.24	5.0	$0.049
Purchased	Oats	$450	90%	$500	$10	5%	$537	$0.53	10.5	$0.050

In this scenario, we showed that despite the high cost of fertiliser inputs, use of nitrogen fertiliser (urea) and growth promotants (Gibberellic Acid) was cost effective compared to purchasing in feed on an energy basis, dollars per mega-joule ($/MJ).

4.3 Extension and communication

Extension activities were hampered by wet conditions and flooding in the first year across parts of Tasmanian. After rescheduling Field days, an on-farm update was provided to Aggregate Producers (a total of 29 core producers in a closed group setting) during benchmarking meetings.

To engage wider audiences outside of core producers, a webinar event titled *"Fertiliser 2023: Getting bang for your buck"* was hosted on the 15th November 2022. This included:

1. Presentation on the project background and progress to date
2. Initial cost-benefit analysis of the Peddie's first year data
3. Update on managing soil acidity in pasture & mixed farming systems - Dr. Jason Condon, Charles Sturt University

Of the 61 registrations, there were 31 attendees at the webinar. The summary of audience breakdown is listed below.

Table 4 Webinar event registrations and attendee summary by audience type

Type of Audience	Registration (n)	Registration (%)	Attendees (n)	Attendees (%)
Core Producer	6	10%	4	13%
Observer	55	90%	27	87%
TOTAL	**61**		**31**	

The webinar proved to be successful in engaging producers outside of the Aggregate's Tasmanian based clients.

4.4 Monitoring and evaluation

Pre-project knowledge, attitude, skills, and aspiration (KASA) surveys allowed for effective capture of the project audience. Table 5 shows the breakdown of core, observer and non-producers audiences engaged over the course of the project; Table 6 shows the type of producer operations and Table 7 the total area, beef, and sheep under management.

Table 5 Summary of audience by type

Audience Type	Number	%
Core Producer	36	61%
Observer Producer	21	36%
Observer (non-producer)	2	3%
TOTAL	**59**	**100%**

Table 6 Summary of producer audience by operation type

Producer Type	Number	%
Beef and/or sheep + cropping producer	**19**	**39%**
Beef producer (>50% farm income)	**2**	**4%**
Sheepmeat producer (>50% farm income)	**21**	**43%**
Other	**7**	**14%**
Semi-retired	1	2%
Wool producer	6	12%
TOTAL	**49**	**100%**

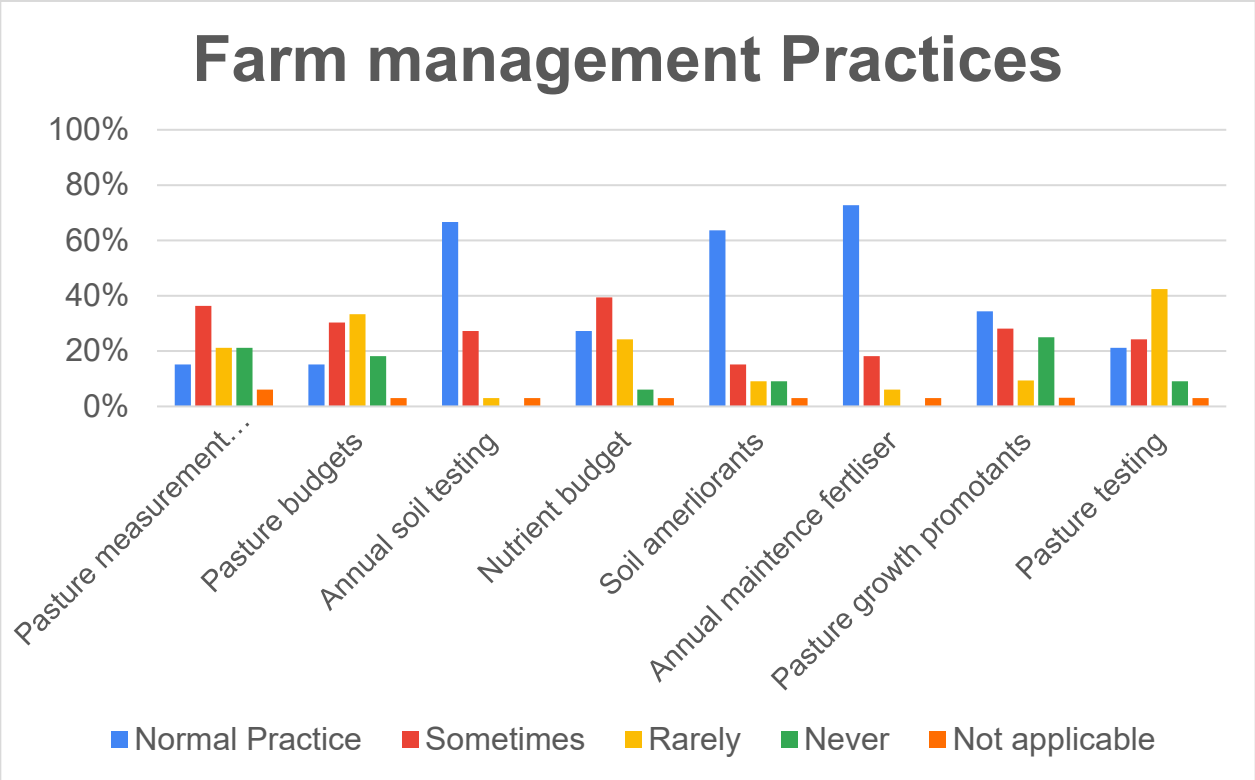
Table 7 Summary of total area, cattle, and sheep by audience type

Audience type	Area managed (ha)	Total Cattle (head)	Total Sheep (head)
Core Producer	110,220	21,056	551,967
Observer Producer	44,063	28,208	244,580
Observer (non-producer)	0	0	0
TOTAL	**154,283**	**49,264**	**796,547**

Farm management practices, confidence and interest were also captured as part of initial KASA project. 33 responses from a total 57 producers were completed to a satisfactory level. Their responses as represented in graphical representations below in graphs 1, 2 and 3.

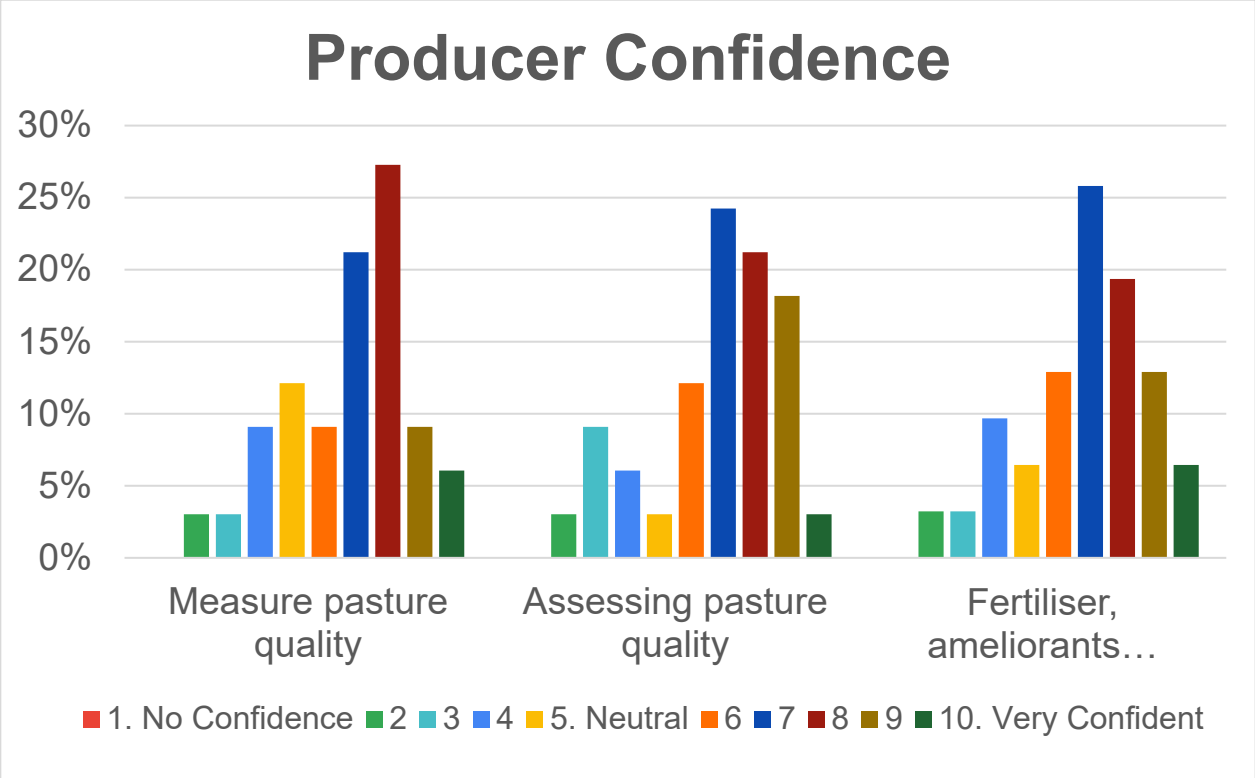
Annual soil testing, use of soil ameliorants and application of maintenance fertiliser were common practice. Measuring pasture quantity and quality, budgeting for pasture and nutrients, and use of growth promotants were not routine operations.

Graph 1 Shows prevalence of management practices from producers



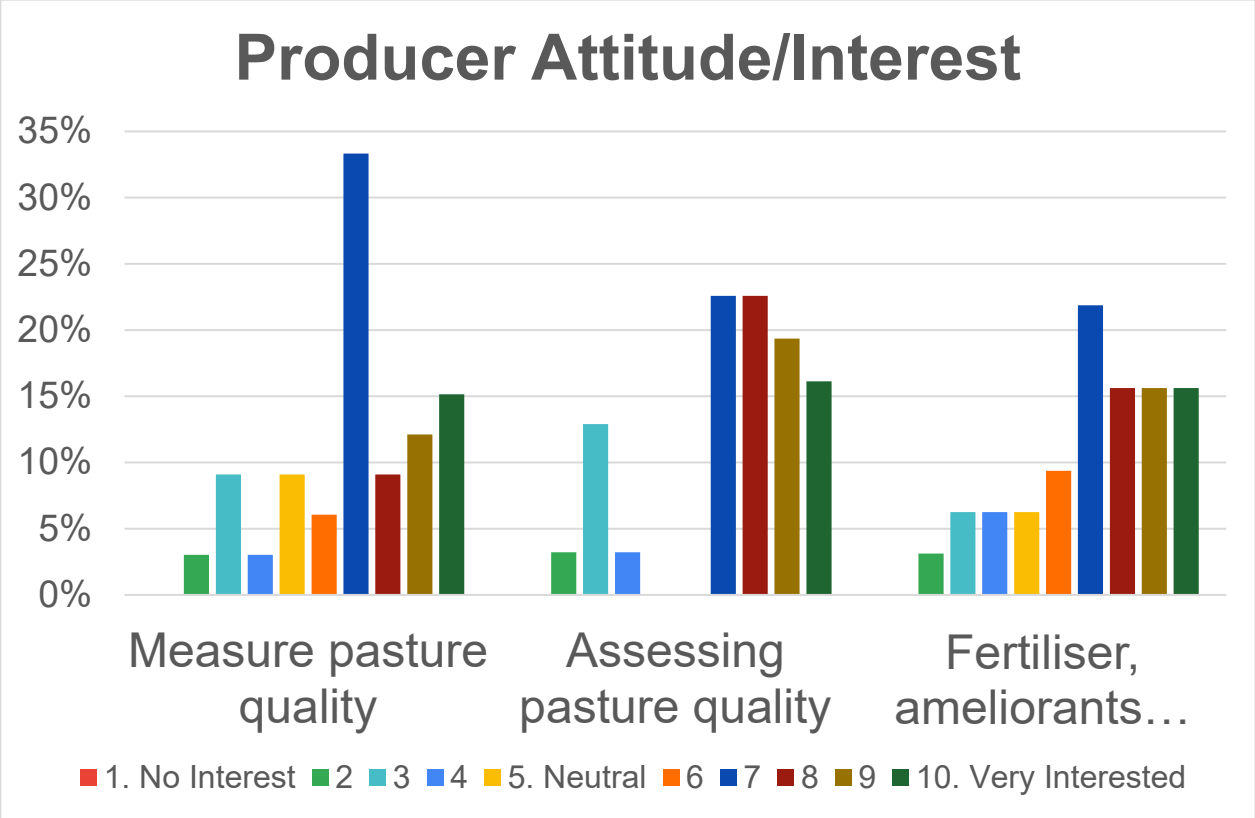
When it comes to confidence is understanding and using pasture managements all producers had some level of assurance with no “no confidence” responses noted. Producers were more confident in measuring pasture quantity than assessing quality. They also had high levels of confidence when it came to using fertiliser or ameliorants.

Graph 2 Shows confidence around use of pasture management practices



Despite the highest of levels in confidence in pasture measurement there was continued interest from producers in learning about this topic. The strongest levels of interest align with the lower levels of confidence for pasture quality and fertiliser/ameliorants.

Graph 3 Shows attitude /interest towards use of pasture management practices



It was also noteworthy that the average mid-winter stocking rate 10.6 dse/ha for respondents, versus an annual average stocking rate of 13.7 dse/ha. This difference of 3.1 dse/ha demonstrates winter is still a constraint to optimising stocking rates throughout the year.

5. Conclusion

5.1 Key Findings

- Even with high-cost fertiliser inputs, use of nitrogen fertiliser (urea) and growth promotants (Gibberellic Acid) can be cost effective compared to purchasing in feed on an energy basis. This will be dependent on:
    - Timing of application and response to N
    - That winter represents the feed limiting period and the operation is approaching an optimum stocking rate
    - The cost of alternative feeds
- Though the key objectives on increasing carrying capacity by 25%, increased animal production by 25% & enterprise profit by 20% were not met, there were some clear positives:
    - A 16% increase in pasture growth rates was captured with increasing growth promotants application (gibberellic acid) from one to two applications
    - Utilising fertiliser and growth promotants were 22% more cost effective than the cheapest purchased feed

- Operations must have the data and ability to assess whether use of fertiliser & growth promotants, feeding conserved feed or purchasing in feed is the most cost-effective option for their operation
- Feed availability in winter was still the constraint to increasing overall annual stocking rates in the operations surveyed.
- Most producers surveyed are confident in their ability to quantify the amount but less confident in their ability to determine pasture quality and utilise pasture fertiliser, ameliorants, and growth promotants

5.2 Benefits to industry

The winter feed gap still poses a production constraint to red meat operations located in the south-eastern states of Australia. Addressing this gap through cost-effective pasture management strategies will provide a viable option for producers to implement to boost their productivity and their profit.

This project has demonstrated proven pasture management strategies, is still the most cost-effective way to boost winter feed production, even with high fertiliser input prices. These management strategies and the PDS methodology can be replicated on-farm. This involves quantifying operation variables inclusive of:

- Pasture quantity and quality for feed budgeting
- Livestock class, pregnancy status and numbers to identify feed deficits or surpluses
- The cost of fertiliser inputs and alternatives such as conserved or purchased in feeds

Given the high fertiliser prices, the PDS economic benefits of fertiliser versus purchasing feed were limited when compared to historical fertiliser pricing trends. In lower fertiliser pricing conditions, it would be worthwhile further demonstrating the effectiveness of these pasture management techniques for both improved and native pasture management across a variety environmental condition.

6 Appendices

6.1 Initial Soil Test results – May 2022 sampling

INTIAL SOIL TEST RESULT - MAY 2022

Operation			Ellis	Ellis	Green	Green	Peddie	Peddie
Paddock names			Home Run East	Home Run West	Tree Guard	Cattle Yard	6A East	Six B West
Designated			Control	Treatment	Control	Treatment	Control	Treatment
	Units	LOR						
pH ($CaCl_2$)	pH units	0.04	5.5	5.4	5	4.9	5	4.9
Elect. Cond.	dS/m	0.001	0.21	0.14	0.11	0.1	0.089	0.11
Texture**			Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Loam	Sandy Loam	Sandy Loam
ECe Cal.	dS/m	0.001	2	1.3	1.1	0.97	1.2	1.5
S (KCl_{40})	mg/kg	2	33	21	11	9.2	10	9.8
Colwell P	mg/kg	2	73	55	25	18	57	82
Al	cmol(+)/kg	0.1	<0.1	<0.1	<0.1	<0.1	0.16	0.12
Ca	cmol(+)/kg	0.03	12	8.8	7.4	6.8	3.3	3.3
K	cmol(+)/kg	0.01	0.37	0.26	0.42	0.44	0.42	0.52
Mg	cmol(+)/kg	0.007	4.6	2.8	2.3	2.1	0.68	0.74
Na	cmol(+)/kg	0.03	0.39	0.24	0.12	0.11	0.067	0.035
CEC (effective)	cmol(+)/kg	0.20	17	12	10	9.4	4.6	4.7
Ca / Mg			2.5	3.1	3.3	3.3	4.9	4.4
% Al Sat.	% of ECEC		N/A	N/A	N/A	N/A	3	2
Exch. Ca	% of ECEC		68	73	72	72	71	70
Exch. K	% of ECEC		2.2	2.1	4.1	4.7	9.2	11
Exch. P	% of ECEC		27	23	22	22	15	16
Exch. Na	% of ECEC		2.3	2	1.2	1.1	1.4	0.74
Potassium	%	0.0004	0.032	0.033	0.027	0.032	0.027	0.033

SOIL TEST NOTES & NUTRIENT PLANS CONSIDERATIONS

P	Surplus; focus on N	P treatment focus	Surplus; focus on N
pH	Acceptable for now	Act now but how	Limed post testing
Lime	Long term needs?	Ground spread not viable	NA